VOLUME 1 NUMBER 1

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LOVE AVIATION AND SPACEFLIGHT? **PASS IT ON!**

ALL OF YOU WHO LOVE AIRPLANES, we've noticed, want to share your favorite pastime. We can help! That's why we've created this special section—with news, information, and advice about careers in aerospace. If you are a young person looking for or just starting a career in space or aviation, you'll meet others with similar interests here who will share their experiences. If you have been in the field for a while, rip out these four pages! Put them in the mail to a young friend or relative. Email them the link at the top of the page, or hand off the entire magazine. Let's work together to keep the U.S. aerospace industry and aviation community strong. —*The editors*

I love my job, and here's how I got it

Jamie Mitchell is Flight Coordinator at the Collings Foundation on the Wings of Freedom Tour

JAMIE MITCHELL'S OFFICE is the navigation desk of a B-17G. Sometimes while she's eating lunch, she'll look out the window and see a B-24 flying in formation with the B-17. "That's what we call a traffic jam," she jokes. The B-17, *Nine-O-Nine*, is one of just 10 airworthy Flying Fortresses remaining in the world.

The job: 330 days, 40 states, 120 cities: As the Wings of Freedom Tour travels the country, Mitchell coordinates visitor flights on the Boeing B-17G, Consolidated B-24J, and North American TB-25J and P-51C.

Typical day: She helps visitors tour the aircraft, coordinates 30-minute passenger flights, and encourages area veterans (and their families) to fly with them to their next stop, typically 40 minutes away.

The path: In 2013, Mitchell, a geologist at the Jet Propulsion Laboratory in California, volunteered at the Planes of Fame Air Museum. There she met a group of Stearman enthusiasts and started flight lessons. During a 2015 conference in Houston, she saw that the Wings of Freedom Tour was in town. She stopped by, introduced herself, and applied for the job.

The staff: Pilot Rober Pinksten, lead mechanic Gary Dunn, and Mitchell. Everyone else is a volunteer. About 100 people volunteer during the season.

Philosophy: Once she and a fellow airline passenger began talking about a glider model she was carrying. At her urging, the passenger arranged rides for his sons through the Experimental Aircraft Association Young Eagles program. She says, "If a little toy glider can get a guy to take all three of his sons out for their first flight with Young Eagles, then who knows? I've got three bombers and a Mustang. I can do even more!"

Jamie Mitchell at the office, a B-24 cockpit: She often gets publicity for the Collings Foundation tour by inviting local TV reporters to broadcast the weather from one of the aircraft.

TOP: DJOMAS/SHUTTERSTOCK.COM; BOTTOM: TIM SHORT

Tony Zhao and Milton Marwa connect the battery cable to an experimental engine and prop at the Eagle Flight Research Center in Florida. Above right: Victoria Li and Marwa work on an airframe for the hybrid engine project.

How is an aircraft propulsion system like a stack of pancakes?

AT THE EAGLE FLIGHT RESEARCH CENTER of Embry-Riddle Aeronautical University in Daytona Beach, a group of graduate and undergraduate students are working a problem that aeronautical engineers the world over would like to solve: how to make an airplane go far and fast without being a noisy, polluting gas guzzler. And when I say working a problem, I mean *working* a problem. Master's degree candidate Tianyuan "Tony" Zhao, who graduated last year from Embry-Riddle with a bachelor's degree in aerospace engineering and computational math, says the center emphasizes hands-on learning. "Like soldering circuits for test equipment," he says. "We hadn't learned how to do that in a classroom."

The students are designing and building a hybrid electric-gas turbine engine as their contribution to reducing aircraft gas consumption, noise, and emissions. Eagle Center director Pat Anderson, a certified flight instructor and airplane-and-powerplant mechanic as well as a Ph.D. in mechanical engineering, says students at the university are aware of the environmental impact of flight because they're around it all the time. "They see 70 airplanes being dispatched every day," he says, referring to Embry-Riddle's flight training programs. "Hybrid or electric propulsion is exciting to these students because its first practical use will be in flight instruction—right where they're at with their buddy students."

Victoria Li, a graduate student who concentrated on electrical engineering in her first two years of undergrad work before switching to aerospace engineering, is designing the battery management system for the electric engine. "There is not a single big battery that we can implement on this aircraft," she says. "We're using cylindrical lithium-ion batteries"—"similar in shape and size to AA batteries, but with more energy storage capacity," Zhao chimes in—"and we have a couple thousand of them on board to power the airplane, so to manage a couple thousand batteries, we need a complicated battery management system." The students hope to connect them in such a way as to increase the capacity of the whole system.

Milton Marwa came to the project because his first interest was propulsion, and he'd been studying gas turbine engines. Marwa remembers that one of his professors, teaching a class on advanced gas turbine theory, started off by saying, "The gas turbine has been around for over 100 years, and there's nothing new about it." Marwa

A&S QUIZ

PUT YOUR OWN OXYGEN MASK ON FIRST

If an airliner loses pressure, how many seconds does your brain function well?

If you guessed about 60, you're right, according to scientists at Arizona State University. Read more about rapid pressure loss in "What Went Wrong on Flight MH370?" on page 30 or at ***airspacemag.com/MH370.***

continues, "He let us pick our own propulsion system to study. When I learned that this project would produce a hybrid engine, I was in."

It's early days for the hybrid engine project, and most of the work so far has been computation and research. "This borrows a little from Professor Anderson," says Li, "but the purpose of our project is to change the aspect of looking at the problem. If you want good range, you'll use gas. Our goal is to reduce noise and emissions." What kind of engine can meet that goal and still have acceptable range?

Marwa knows the engine won't be built by the time he graduates in December. "This is what keeps me up at night," he says, making his colleagues laugh. "Do I keep at it, as a Ph.D. student, or take a job in industry where there is only a slim chance of doing similar work?"

Maybe he will find an opportunity at Boeing, where engineers, under a contract from NASA, are studying an airplane that would use gas turbines for power-hungry operations like takeoff and electric engines for cruise. Siemens and Airbus have also teamed up to develop hybrid engines. Both Boeing and Airbus are predicting hybrid power for airliners by about 2030.

"A lot of people are talking about [building a] serial hybrid," says Marwa. "They're going to have a gas turbine generating electricity to drive an electric motor and charge a battery, which can also power the electric motor. And the motor then runs a propeller. With all those moving parts, there is a stacking of inefficiencies. We haven't seen anyone who is looking at it from that point of view: that stacking of inefficiencies. We want to create an architecture that has the least stacking of inefficiencies."

Like pancakes. The students at Embry-Riddle's Eagle Flight Research Center are aiming for a short stack. **LINDA SHINER**

Unbelievable. But True!

Fly Etihad, with Nicole Kidman

The airline offers a five-minute tour in virtual reality, complete with a plot.

A still from the virtual reality tour of an Etihad Airways A380. Inset: A poster of the VR tour's star.

IN A FIVE-MINUTE STROLL through the priciest sections of the world's largest passenger aircraft—an Airbus A380 operated by Etihad Airways—actress Nicole Kidman discusses a scene with her director, then meets her butler, inflight chef, and nanny, before curling up for a nap in a three-room suite named The Residence. If the best seat you can afford is in Economy, you can still tag along for the immersive 360-degree trip and follow the A380's progress from New York to Abu Dhabi, using a virtual reality (VR) headset.

The five-minute VR film *Reimagine*, released last spring, took six months to produce and was shot in Abu Dhabi, the capital of the United Arab Emirates. During one three-day shoot, vast blocks of seats, overhead bins, and bulkheads were removed and hundreds of lights installed to allow a continuous camera shot through the A380's two decks. The result is a sweeping tour without any stitching.

Etihad Airways first released the film exclusively for users of the Samsung Gear VR, Oculus Rift, and Google Cardboard headsets, which require an app to view, but then added a non-VR version with full stereoscopic sound on YouTube.

Find the link at ***airspacemag.com/etihad***

Add It to Your Bookshelf

Space Careers

BY LEONARD DAVID AND SCOTT SACKNOFF

For anybody looking for a career in space engineering or exploration, this book is very handy. It lists all colleges and universities with accredited programs in space disciplines as well as websites and contact information for all U.S. aerospace companies and institutions. You'll find advice on résumé writing, interviewing, networking, finding out who's hiring, and starting your own business.

FROM THE BOOK: Marilyn Hewson, president and CEO of Lockheed Martin, reveals questions she'd ask at a job interview. "How did you spend the first 90 days of your previous job? The best employees are those who bring real energy and initiative to the job. I like to know whether you're the kind of person who can set priorities, take initiative, and drive results right from the beginning."

TOP: COURTESY ETIHAD AIRWAYS

Jason Erickson has a heart-to-heart with each intern at the end of their time at Wipaire. Among the jobs company employees do: Affix Wipline 13000 floats to a Viking DHC-6 Twin Otter to make it a floatplane (top).

5 Tips for Internships

Wisdom from Wipaire, a company with a thriving internship program.

JASON ERICKSON is the director of maintenance at Wipaire, Inc., a 225-person maker of airplane floats in St. Paul, Minnesota, which also does airframe modifications, interiors, avionics, and maintenance. He offers advice for potential interns.

1. Initiate.

Wipaire's Gateway to Success internship program started when Alex Walker, who had just completed a year of study in airframe-and-powerplant mechanics, asked to work as an intern. Erickson thought *Why not?* and offered Walker a job in which he could learn a few things about airframe maintenance and modification. Today, Walker is a mechanic for Delta Air Lines.

The lesson, says Erickson, is copy Walker's approach. He says, "If you have a hometown airport that has a maintenance facility, go in and say, 'Hey I want to be an A&P. Would you be willing to take me on for the summer?' "

2. Get it on your résumé.

"When I'm looking for an employee, I want to see how a prospect can adapt to aviation," says Erickson. "If she's already had an aviation job or internship, that's a big asset. We pay our interns a decent summer-job wage, but if you can afford to, even do it for free. It may get you to a paying job."

3. Keep it local.

Even if you get paid for an internship, you're not going to be making a ton of money. Erickson says most of his interns have had family and friends in the area so they don't have to worry too much about housing costs and transportation.

4. Be professional.

Erickson has written letters of recommendation for every intern who has completed Wipaire's program, but he doesn't guarantee that one will be written. "I had one intern who displayed some interesting music and coffee pot integration in his toolbox," he says. "So I told him that those things may seem harmless, but it just sends a bad message."

5. Open your mind.

Erickson notes that an A&P certificate is called "a license to learn." In a Wipaire internship, he says, the new workers stand side by side with experienced mechanics and work with supervision on real airplanes. "By the end of the summer," says Erickson, "they're one of the team."

A&S NEXT

Let us hear from you! Have you just soloed? Started a new job? Finished an internship? Invented an aeronautical gadget? Tell us about your experience, and send us a photo. *editors@si.edu* or *facebook.com/AirSpaceMag*

COURTESY WIPAIRE, INC. (2)